

FINAL REPORT

EXECUTIVE SUMMARY

# I-10/SR 85 Corridor Profile Study

*California State Line to I-8*

PREPARED FOR **ADOT** MARCH 2017

ADOT WORK TASK NO.  
MPD 013-16

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Prepared by

**AECOM**







# EXECUTIVE SUMMARY

## INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of Interstate 10 (I-10) between the California State Line and State Route 85 (SR 85), and SR 85 between I-10 and Interstate 8 (I-8). This study examines key performance measures relative to the I-10/SR 85 Corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings. The I-10/SR 85 Corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS.

### Corridor Study Purpose, Goals and Objectives

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

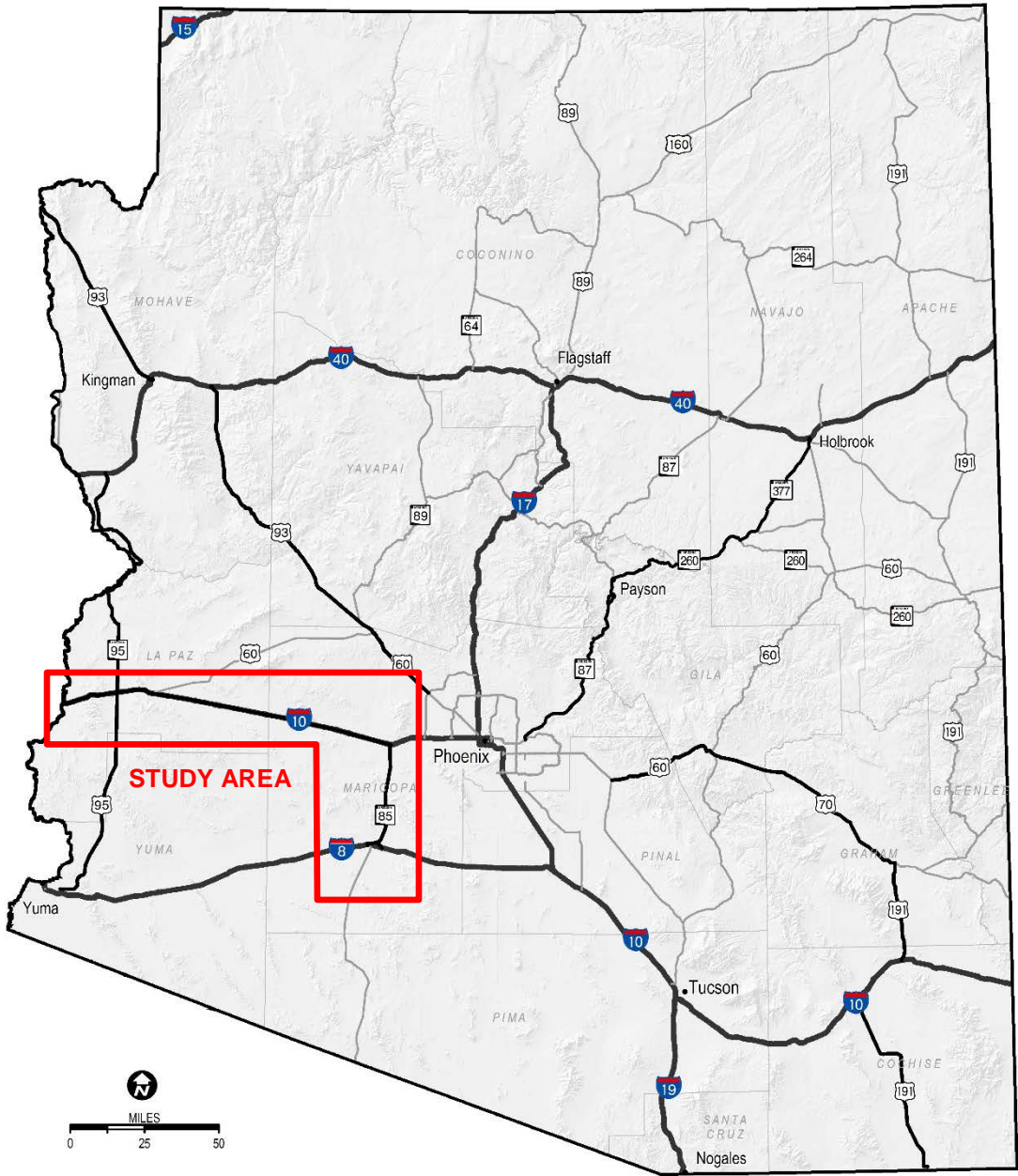
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The I-10/SR 85 Corridor Profile Study defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals are identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals.
- Develop solutions that address identified corridor needs based on measured performance.
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure.

Figure ES-1: Corridor Study Area

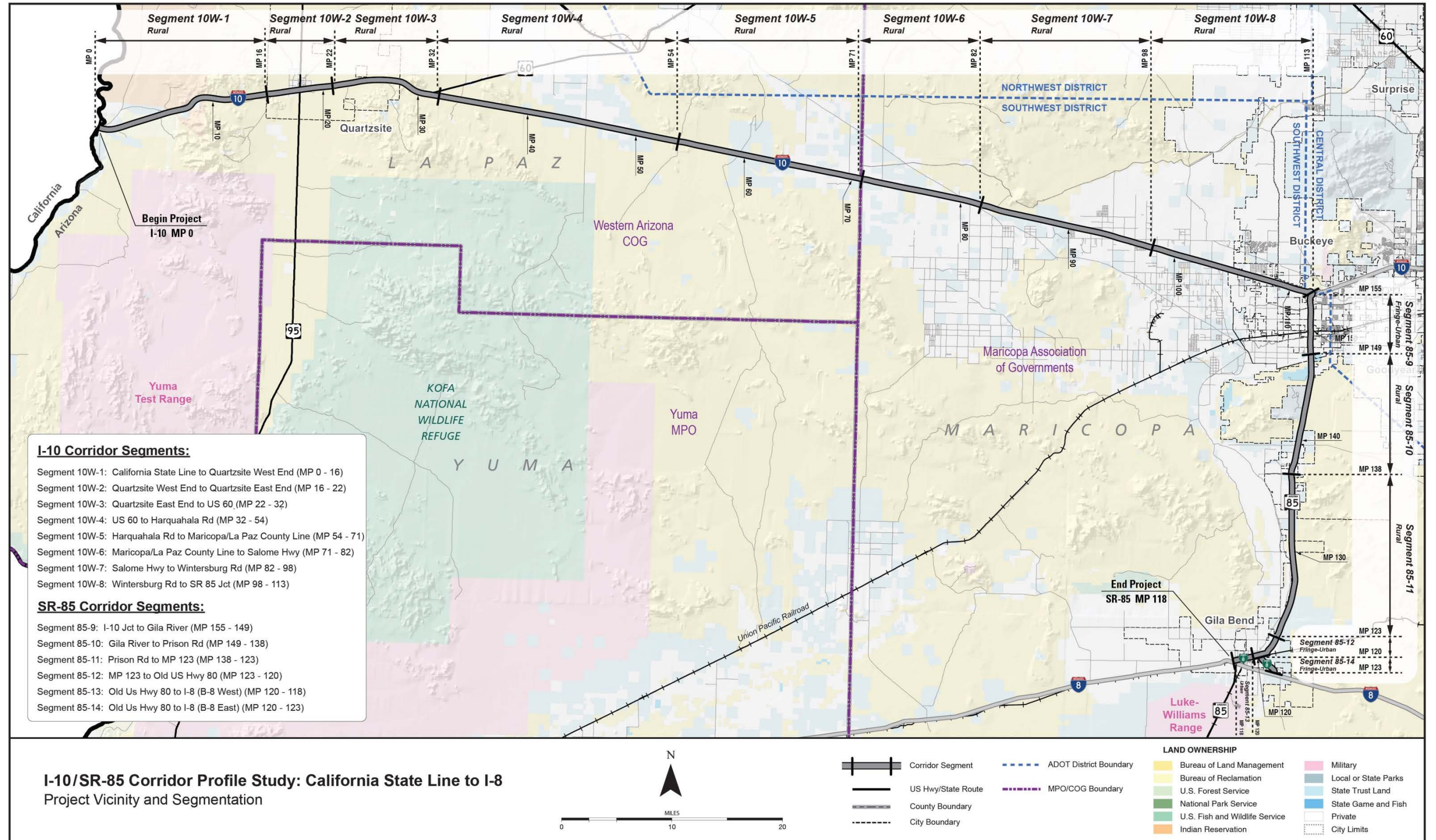


### Study Location and Corridor Segments

The I-10/SR 85 Corridor is divided into 14 planning segments for analysis and evaluation. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are shown in **Figure ES-2**.



Figure ES-2: Corridor Location and Segments





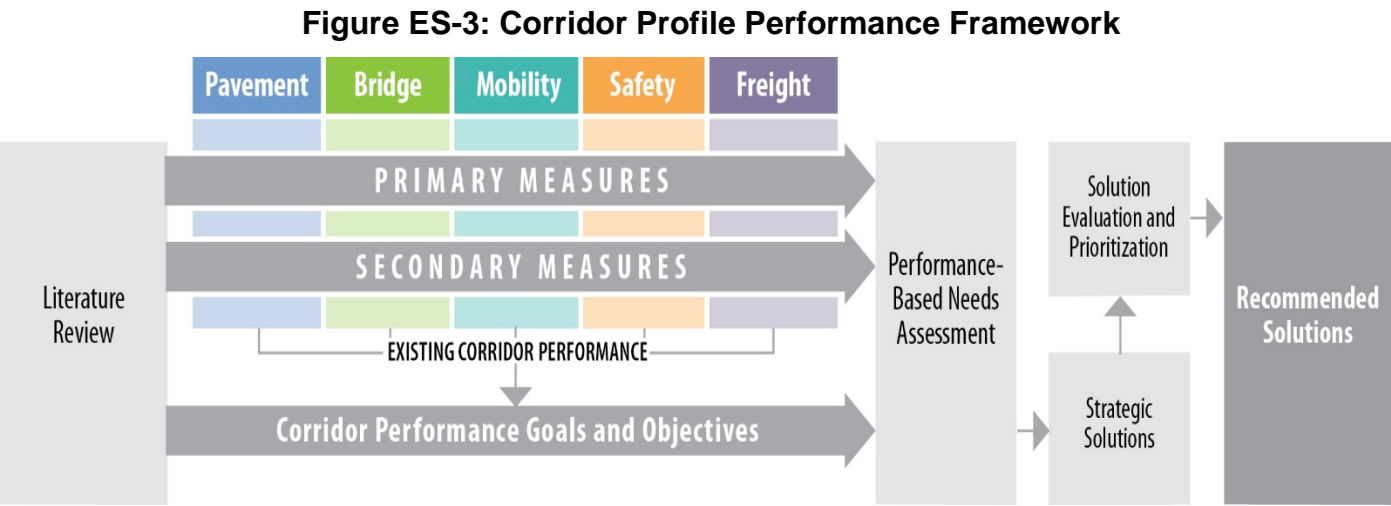
## CORRIDOR PERFORMANCE

A series of performance measure is used to assess the I-10/SR 85 Corridor. The results of the performance evaluation are used to define corridor needs relative to the long term goals and objectives for the corridor.

### Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

**Figure ES-3** illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance.



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance. **Table ES-1** provides the complete list of primary and secondary performance measures for each of the five performance areas.

**Table ES-1: Corridor Performance Measures**

Performance Area	Primary Measure	Secondary Measures
Pavement	<b>Pavement Index</b> Based on a combination of International Roughness Index and Cracking	<ul style="list-style-type: none"> <li>• Directional Pavement Serviceability</li> <li>• Pavement Failure</li> <li>• Pavement Hot Spots</li> </ul>
Bridge	<b>Bridge Index</b> Based on lowest of deck, substructure, superstructure and structural evaluation rating	<ul style="list-style-type: none"> <li>• Bridge Sufficiency</li> <li>• Functionally Obsolete Bridges</li> <li>• Bridge Rating</li> <li>• Bridge Hot Spots</li> </ul>
Mobility	<b>Mobility Index</b> Based on combination of existing and future daily volume-to-capacity ratios	<ul style="list-style-type: none"> <li>• Future Congestion</li> <li>• Peak Congestion</li> <li>• Travel Time Reliability</li> <li>• Multimodal Opportunities</li> </ul>
Safety	<b>Safety Index</b> Based on frequency of fatal and incapacitating injury crashes	<ul style="list-style-type: none"> <li>• Directional Safety Index</li> <li>• Strategic Highway Safety Plan Emphasis Areas</li> <li>• Crash Unit Types</li> <li>• Safety Hot Spots</li> </ul>
Freight	<b>Freight Index</b> Based on bi-directional truck planning time index	<ul style="list-style-type: none"> <li>• Recurring Delay</li> <li>• Non-Recurring Delay</li> <li>• Closure Duration</li> <li>• Bridge Vertical Clearance</li> <li>• Bridge Vertical Clearance Hot Spots</li> </ul>

Each of the primary and secondary performance measures identified in the table above is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

- Good/Above Average Performance** – Rating is above identified desirable/average range
- Fair/Average Performance** – Rating is within identified desirable/average range
- Poor/Below Average Performance** – Rating is below identified desirable/average range

The terms “good”, “fair”, and “poor” apply to the Pavement, Bridge, Mobility, and Freight performance measures, which have defined thresholds. The terms “above average”, “average”, and “below average” apply to the Safety performance measures, which have thresholds referenced to statewide averages.



**Corridor Performance Summary**

**Table ES-2** shows a summary of corridor performance for all primary measures and secondary measure indicators for the I-10/SR85 Corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**.

94% of the corridor segments show “Good” performance in the Pavement Index. Approximately 96% of the segments show “Good” performance in Mobility, while the remaining 4% show “Poor” performance. In the Freight Index, approximately 65% of the segments show “Good” performance, while 20% is rated “Fair” and 15% is rated “Poor”. The Bridge index displays only 30% of the segments in “Good” condition, and 70% in “Fair” condition. Almost half of the corridor segments in the Safety index show as “Below Average” condition, where 31% of the segments show as “Average” condition, and only 22% show “Above Average” performance.

It appears that the lowest performance along the I-10/SR 85 Corridor occurs in the Bridge and Safety Performance Areas while the Pavement and Mobility Performance Areas showing the highest performance.

- The pavement is generally in “good” condition with the exception of a few isolated locations
- The bridges are generally in “fair” condition overall with only eight bridges with a single rating of 5 along the corridor.
- The general mobility and freight indices along the corridor are displaying “good” performance where both are also showing very little recurring and non-recurring delays along the I-10 portion of the corridor. The segments along SR 85 show elevated levels of delay in the southern end of the corridor.
- The closures along the corridor are generally lower than the statewide average for both the closure frequency and duration, however there is one outlier in segment 9 in the southbound direction
- Overall, based on the weighted average of the Safety Index, the corridor rates in “below average performance” condition.
- There are a few hot spot crashes throughout the corridor in Segments 10W-3 through 10W-8 and in Segment 85-9.



Table ES-2: Corridor Performance Summary by Segment and Performance Measure

Segment	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		Pavement Failure	Bridge Index	Bridge Sufficiency	Bridge Rating	% Deck Area of Functionally Obsolete Bridges	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/milepost/ year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Acc.	% Non-Single Occupancy Vehicle (SOV) Opportunities
			EB/SB	WB/NB								EB/SB	WB/NB	EB/SB	NB/WB	EB/SB	NB/WB	EB/SB	NB/WB		
10W-1^a2	16	3.76	3.96	3.93	13.0%	5.11	67.26	5	5.8%	0.27	0.30	0.28	0.28	0.05	0.30	1.20	1.17	1.57	1.54	100.00%	11.9%
10W-2^a2	6	3.61	3.87	4.06	0.0%	5.92	95.30	5	9.0%	0.30	0.32	0.29	0.29	0.03	0.23	1.13	1.10	1.30	1.25	100.00%	15.2%
10W-3^a2	10	3.90	3.88	3.97	0.0%	6.00	87.89	6	36.8%	0.27	0.29	0.28	0.28	0.18	0.08	1.15	1.10	1.34	1.24	99.00%	19.7%
10W-4^a2	22	3.76	3.52	3.74	27.0%	6.50	97.22	5	0.0%	0.31	0.34	0.34	0.34	0.11	0.14	1.11	1.09	1.24	1.23	100.00%	10.7%
10W-5^a2	17	4.37	4.22	4.16	0.0%	6.48	98.35	6	0.0%	0.29	0.32	0.29	0.29	0.28	0.13	1.11	1.08	1.27	1.20	100.00%	5.3%
10W-6^a2	11	3.85	3.55	3.68	18.0%	7.00	97.41	7	0.0%	0.29	0.32	0.27	0.31	0.36	0.24	1.10	1.09	1.21	1.23	100.00%	6.1%
10W-7^a2	16	3.95	3.81	3.94	0.0%	6.25	97.70	6	0.0%	0.32	0.36	0.29	0.34	0.11	0.40	1.10	1.10	1.24	1.23	100.00%	12.5%
10W-8^b2	15	3.95	3.67	3.80	13.0%	6.71	96.12	5	0.0%	0.53	0.70	0.34	0.35	0.11	0.12	1.11	1.10	1.25	1.25	100.00%	14.6%
85-9^c1	6	4.01	3.85	3.63	0.0%	NO BRIDGES IN SEGMENT				0.30	0.39	0.18	0.18	0.77	0.07	1.05	1.00	1.32	1.76	1.05	1.00
85-10^c2	11	3.83	3.82	4.11	14.0%	6.53	99.47	6	0.0%	0.23	0.28	0.15	0.16	0.00	0.25	1.07	1.00	1.83	1.07	100.00%	13.6%
85-11^c2	15	3.80	4.35	3.78	22.0%	NO BRIDGES IN SEGMENT				0.17	0.20	0.09	0.09	0.03	0.13	1.09	1.01	1.16	1.84	1.09	1.01
85-12^e2	3	3.32	3.42	3.21	17.0%	5.00	83.40	5	0.0%	0.92	1.11	0.56	0.56	0.07	0.27	1.00	1.19	1.00	3.19	32.00%	8.8%
85-13^d1	2	5.00	5.00	5.00	0.00	5.21	89.61	5	0.0%	0.32	0.35	0.25	0.25	NO DATA AVAILABLE		1.47	1.85	4.26	72.41	47.00%	9.0%
85-14^e1	3	5.00	5.00	5.00	0.00	6.86	94.25	6	0.0%	1.01	1.24	0.66	0.67	NO DATA AVAILABLE		1.89	1.28	4.25	9.05	42.00%	7.0%
Weighted Corridor Average		3.93	3.88	3.85	11.69%	6.26	92.58	5.6	3.9%	0.33	0.38	0.28	0.29	0.15	0.20	1.11	1.11	1.47	1.47	96%	11%
SCALES																					
Performance Level		Interstate (Non-Interstate)								Urban or Rural						Uninterrupted or Interrupted					
Good/Above Average		> 3.75 (3.5)			< 5%	> 6.5	> 80	> 6	< 12%	< 0.71 <sup>1</sup> < 0.56 <sup>2</sup>				< 0.22		< 1.15^ < 1.30*		< 1.30^ < 3.00*		> 90%	> 17%
Fair/Average		3.2 - 3.75 (2.9-3.5)			5% - 20%	5.0 - 6.5	50 - 80	5 – 6	12% - 40%	0.71 - 0.89 <sup>1</sup> 0.56 - 0.76 <sup>2</sup>				0.22 – 0.62		1.15-1.33^ 1.30-2.00*		1.30-1.50^ 3.00-6.00*		60% - 90%	11% - 17%
Poor/Below Average		< 3.2 (2.9)			> 20%	< 5.0	< 50	< 5	> 40 %	> 0.89 <sup>1</sup> >0.76 <sup>2</sup>				> 0.62		> 1.33^ > 2.00*		> 1.50^ > 6.00*		< 60%	< 11%

^Uninterrupted Flow Facility

\*Interrupted Flow Facility

<sup>a</sup>4 Lane Freeway with Daily Volume < 25,000

<sup>b</sup>4 Lane Freeway with Daily Volume > 25,000

<sup>c</sup>2 or 3 or 4 Lane Divided Highway

<sup>d</sup>4 or 4 Lane Undivided Highway

<sup>e</sup>2 or 3 Lane Undivided Highway

<sup>1</sup>Urban Operating Environment

<sup>2</sup>Rural Operating Environment



**Table ES-2: Corridor Performance Summary by Segment and Performance Measure (continued)**

Segment	Length (miles)	Safety Performance Area					Freight Performance Area									
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	Freight Index	Directional Truck TTI		Directional Truck PTI		Closure Duration (minutes/milepost closed/year/mile)		Vertical Bridge Clearance (feet)		
			EB/SB	NB/WB				EB/SB	NB/WB	EB/SB	NB/WB	EB/SB	NB/WB			
10W-1^a2	16	0.76	0.43	1.10	58%	8%	0.71	1.14	1.19	1.36	1.46	50.47	25.03	16.11		
10W-2^a2	6	0.99	0.12	1.86	40%	Insufficient Data	0.89	1.05	1.04	1.13	1.11	43.57	4.80	15.96		
10W-3^a2	10	1.03	1.20	0.87	54%	15%	0.89	1.05	1.04	1.14	1.10	8.78	60.66	16.14		
10W-4^a2	22	1.79	1.92	1.65	54%	11%	0.90	1.04	1.05	1.09	1.12	35.48	136.64	15.90		
10W-5^a2	17	1.60	2.08	1.12	35%	35%	0.87	1.06	1.06	1.17	1.13	42.00	59.85	16.25		
10W-6^a2	11	1.66	2.62	0.70	56%	17%	0.90	1.06	1.05	1.11	1.12	100.12	97.78	16.00		
10W-7^a2	16	2.60	1.48	3.72	40%	20%	0.88	1.05	1.06	1.13	1.15	197.56	36.99	16.58		
10W-8^b2	15	1.05	1.39	0.71	50%	19%	0.90	1.04	1.04	1.11	1.12	44.39	31.35	15.92		
85-9^c1	6	3.12	3.05	3.20	Insufficient Data	Insufficient Data	0.66	1.00	1.07	1.40	1.64	17.87	187.62	No UP		
85-10^c2	11	0.54	1.08	0.00	Insufficient Data	Insufficient Data	0.73	1.11	1.00	1.71	1.03	93.75	0.00	No UP		
85-11^c2	15	0.26	0.50	0.03	Insufficient Data	Insufficient Data	0.65	1.06	1.15	1.15	1.94	21.20	4.17	No UP		
85-12^e2	3	Insufficient Data			Insufficient Data	Insufficient Data	0.60	1.00	1.19	1.00	1.19	1.00	2.35	30.67		
25.03	2	Insufficient Data			Insufficient Data	Insufficient Data	0.14	1.47	2.17	2.17	2.17	2.59	2.59	16.63		
4.80	3	Insufficient Data			Insufficient Data	Insufficient Data	0.17	1.91	1.27	1.27	1.27	3.82	3.82	No UP		
Weighted Corridor Average		1.37	1.44	1.31	49%	18%	0.80	1.10	1.08	1.48	1.32	56.77	61.68	16.12		
136.64																
Performance Level		Urban 4 Lane Freeway or Rural 4 Lane < 25,000 vpd				Uninterrupted or Interrupted						All				
Good/Above Average		< 0.79 <sup>a</sup> < 0.73 <sup>b</sup>			< 49.1% <sup>a</sup> < 42.8% <sup>b</sup>		N/A		> 0.77 <sup>^</sup> > 0.33 <sup>*</sup>		< 1.15 <sup>^</sup> < 1.30 <sup>*</sup>		< 1.30 <sup>^</sup> < 3.00 <sup>*</sup>		< 44.18	> 16.5
Fair/Average		0.79-1.21 <sup>a</sup> 0.73-1.27 <sup>b</sup>			49.1%-59.4% <sup>a</sup> 42.8%-52.9% <sup>b</sup>		N/A		0.67 - 0.77 <sup>^</sup> 0.17 - 0.33 <sup>*</sup>		1.15 -1.33 <sup>^</sup> 1.30 -2.00 <sup>*</sup>		1.30-1.50 <sup>^</sup> 3.00-6.00 <sup>*</sup>		44.18 -124.86	16.0-16.5
Poor/Below Average		> 1.21 <sup>a</sup> > 1.27 <sup>b</sup>			> 59.4% <sup>a</sup> > 52.9% <sup>b</sup>		N/A		< 0.67 <sup>^</sup> < 0.17 <sup>*</sup>		> 1.33 <sup>^</sup> > 2.00 <sup>*</sup>		>1.50 <sup>^</sup> > 6.00 <sup>*</sup>		> 124.86	< 16.0

<sup>a</sup>Uninterrupted Flow Facility

<sup>b</sup>4 Lane Freeway with Daily Volume < 25,000

<sup>c</sup>2 or 3 or 4 Lane Divided Highway

<sup>e</sup>2 or 3 Lane Undivided Highway

<sup>1</sup>Urban Operating Environment

<sup>\*</sup>Interrupted Flow Facility

<sup>b</sup>4 Lane Freeway with Daily Volume > 25,000

<sup>d</sup>4 or 4 Lane Undivided Highway

<sup>2</sup>Rural Operating Environment

Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings



## NEEDS ASSESSMENT

### Corridor Description

The I-10/SR 85 Corridor provides an important connection from Southern California to economic and recreational opportunities in Central Arizona and other destinations to the east. I-10 is a 4-lane divided freeway from the California border to SR 85 while SR 85 is generally a two-lane state route facility connecting I-10 to I-8. Together, the two roadways provide a passage from Southern California to Tucson while bypassing the Metropolitan Phoenix Area.

### Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to I-10/SR 85 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three “Emphasis Areas” were identified for the I-10/SR 85 Corridor, Mobility, Safety, and Freight.

Taking into account the corridor goals and identified Emphasis Areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance Emphasis Areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

### Needs Assessment Process

The performance-based needs assessment evaluates the difference between the baseline performance and the performance objectives for each of the five performance areas used to characterize the health of the corridor: Pavement, Bridge, Mobility, Safety, and Freight. The performance-based needs assessment process is illustrated in **Figure ES-4**.

The needs assessment compares baseline corridor performance with performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure ES-5**.

Figure ES-4: Needs Assessment Process

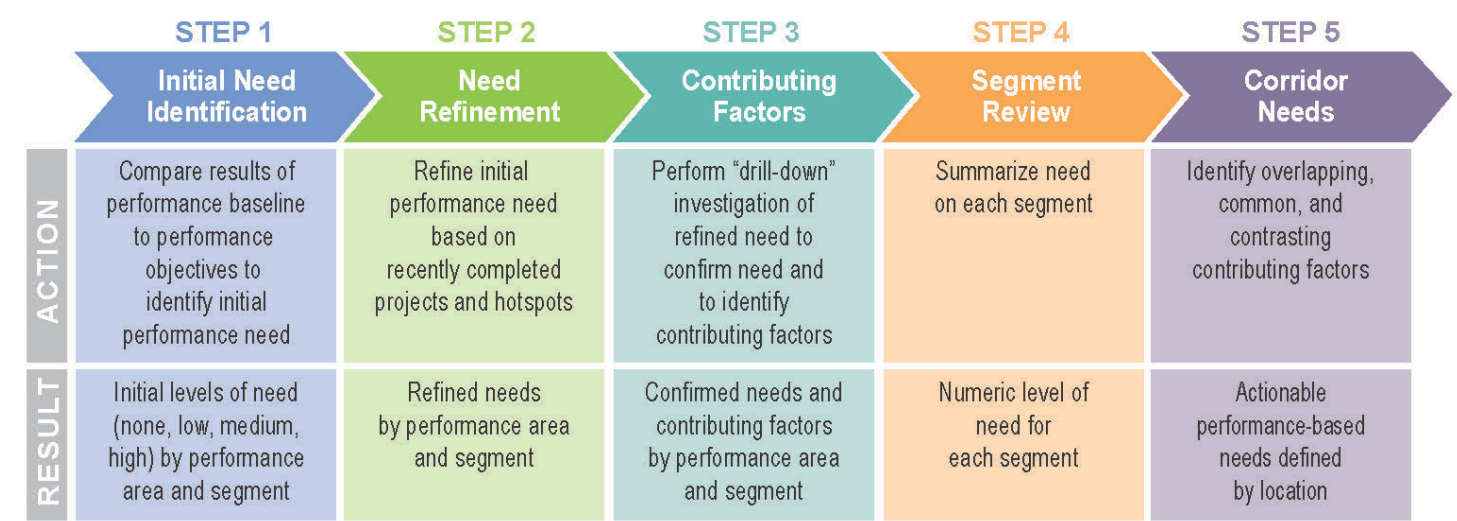


Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
5.0	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
	Fair		
	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. A detailed review of available data helps identify contributing factors to the need and if there is a high level of historical investment.

### Summary of Corridor Needs

**Table ES-3** provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the average need scores of the performance areas identified as emphasis areas (Mobility, Safety, and Freight for the I-10/SR 85 Corridor). There are no segments with a High average need, nine segments with a Medium average need, and five segments with a Low average need. More information on the identified final needs in each performance area is provided below.

#### Pavement Needs

- Pavement failure hot spots were identified on 1 mile of Eastbound I-10, 3 miles of Westbound I-10, and 3 miles of Northbound SR 85.
- Segment 10-4 appears to have a higher level of need in percentage of pavement failure, which may warrant consideration of alternative treatments on the concentrated area.

#### Bridge Needs

- There are zero bridge Hot Spots within the I-10/SR 85 Corridor
- 7 of the 14 segments within the I-10/SR 85 Corridor exhibit Bridge needs
- Only 1 bridge has a current rating of multiple 5's.
- 7 bridges have current deck ratings of 5.
- 3 bridges indicate as Functionally Obsolete in the I-10/SR 85 Corridor
- Only 1 bridge, Tom Wells Rd TI UP at MP 5.84, has potential repetitive investment issues which may be a candidate for life-cycle cost analysis to evaluate alternative solutions.

#### Mobility Needs

- Future (2035) travel demand is anticipated to exceed capacity on approximately 13% of corridor, generally in Buckeye near the I-10/SR 85 Junction, and in Gila Bend.
- A higher than average number of closures, primarily due to accidents and or incidents, occurs on SR 85 from MP 155-149 possibly due to the I-10/SR 85 System Interchange.
- The PTI in Westbound Segment 10-1 exhibits high levels of need due to the California border and Port of Entry. Additionally PTI levels in Northbound Segments 85-13 and 85-14 exhibit high levels of need possibly due to construction activity over the timeframe in which data was collected, and Segment 85-13 serving as Main Street for Gila Bend.

#### Safety Needs

- Safety Needs were identified in ten of fourteen segments, 130 miles (86%) of the corridor.
- The highest levels of need have been identified from MP 32 to 98 on the I-10 portion of the Corridor and from MP 155-149 on the SR 85 portion of the Corridor.
- More than half of the crashes involve single vehicle, which may indicate events due to excessive speed.
- Elevated numbers of rear-end crashes in Segment Northbound 85-9 due to large trucks slowly merging on to I-10 at the Junction.
- Segments 85-10 through 85-14 have too small of a sample to present accurate data.

#### Freight Needs

- The highest level of need was identified on SR 85 from MP 155 to 149 due to the I-10 and SR 85 System Interchange, and B 8 MP 120-118 and 120-123 possibly due to construction. MP 0-16 on I-10 exhibits a medium level of need, due to the Ehrenberg Port of Entry.
- 100% of closures were related to incidents/accidents along the Corridor.
- There are two Bridge Clearance Hot Spots in the Corridor, Ramsey Mine Rd UP located at MP 33.78 and 355<sup>th</sup> Ave UP located at MP 101.4.

#### Overlapping Needs

This section identifies overlapping performance needs on the I-10/SR 85 Corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need. Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Segment 10-1 has overlapping needs in all five performance areas. Pavement needs are impacted by failure hot spots at MP 9-11, MP 13, and MP 15. Bridge needs are impacted by the Tom Wells Rd TI UP at MP 5.84 being identified for historical review. Additionally, the Ehrenberg Bridge at MP 1.01 and Poston Rd TI UP at MP 0.62 both have ratings of 5. Mobility and Freight in Segment 10-1 are impacted by the high PTI values due to Ehrenberg POE at the Arizona/California border. Safety needs are impacted by a high percentage of fatal and incapacitating injury crashes involving SHSP top 5 Emphasis Areas Behaviors.
- Segment 10-2 has overlapping needs in Bridge, Safety, and Freight. Bridge needs are impacted by the structural rating of the West Quartzsite TI UP Bridge at MP 17.50 and the SR 95 UP at MP 18.89. Safety needs are impacted by the Safety Index and the WB Directional Safety Index. Freight is impacted by the West Quartzsite Pedestrian Overpass having low clearance, though it does have a ramp-around option for oversize mainline traffic to avoid the bridge.



- Segment 10-3 has overlapping needs in Safety and Freight. Safety needs are impacted by Safety Hot Spots at Westbound MP 25 and MP 29. Additionally, Safety needs are impacted by a high percentage of Fatal and Incapacitating Injury Crashes in the segment. Freight needs are impacted by the Brenda TI UP at MP 31.17 which does not have a ramp to allow oversize mainline traffic to avoid bridge.
- Segment 10-4 has overlapping needs in Pavement, Bridge, Safety, and Freight. Pavement needs are impacted by Failure Hot Spots at EB Mileposts 36-37, 38-45, and 47-48, and WB Mileposts 41-42, 47-48, and 51-52. Bridge needs are impacted by the structural rating of Vicksburg Road TI UP located at MP 45.34. Safety needs are impacted by Directional Safety Index and a high percentage of Fatal and Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors. Safety Hot Spots are located at WB MP 49 and EB Mileposts 35, 37, and 42. Freight needs are impacted by the Ramsey Mine Rd UP at MP 33.78, which is a Truck Height Restriction Hot Spot. Additionally, Freight needs are impacted by the high levels of Closure Duration in the EB direction.
- Segment 10-5 has overlapping needs in Safety and Freight. Safety needs are impacted by Safety Index, Directional Safety Index, and a high percentage of Fatal and Incapacitating Injury Crashes Involving Trucks. Safety Hot spots are located at EB Mileposts 61-62. Freight needs are impacted by roadway closures due to incidents or accidents, and low bridge clearance.
- Segment 10-6 has overlapping needs in Pavement, Mobility, Safety, and Freight. Pavement needs are impacted by Directional PSR and Failure Hot Spots which are located at EB Mileposts 77-79 and WB Mileposts 71-73. Mobility needs are impacted by a low level of closure frequency in the EB direction. Safety needs are impacted by the Safety Index, EB Directional Safety Index, a high percentage of Fatal and Incapacitating Injury Crashes involving SHSP Top 5 Emphasis Areas Behaviors, and a high percentage of Fatal and Incapacitating Injury Crashes Involving Trucks. Safety Hot Spots are located at WB Mileposts 70-74. Freight needs are impacted by medium and low levels of Closure Duration due to incidents or accidents, and low bridge clearance.
- Segment 10-7 has overlapping needs in Mobility, Safety, and Freight. Mobility needs are impacted by Closure frequency in the WB direction. Safety needs are impacted by the Safety Index, Directional Safety Index, and a high percentage of Fatal and Incapacitating Injury Crashes Involving Trucks. Safety Hot Spots are located at EB Mileposts 82 and 86-88.

Freight needs are impacted by elevated levels of Closure Duration in the WB direction and Bridge Clearance.

- Segment 10-8 has overlapping needs in Bridge, Mobility, Safety, and Freight. Bridge needs are impacted by the structural rating of Oglesby Road Ramp Bridge UP located at MP 112.75. Mobility needs are impacted elevated levels of Future Daily V/C. Safety needs are impacted by the Safety Index, EB Directional Safety Index, a high percentage of Fatal and Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors, and a high percentage of Fatal and Incapacitating Injury Crashes Involving Trucks. Safety Hot Spots are located at EB Mileposts 107 and 109-112, and WB Mileposts 111-112. Freight needs are impacted by elevated levels of Closure Duration in the WB direction, and a Truck Height Restriction Hot Spot at the 355<sup>th</sup> Ave UP, located at MP 101.4.
- Segment 85-9 has overlapping needs in Mobility, Safety, and Freight. Mobility needs are impacted by elevated Closure Frequencies in the SB direction, elevated PTI in the SB direction, and an at-grade railroad crossing at MP 151 causing delays. Freight needs are impacted by elevated Freight Index, elevated Directional PTI, and elevated Closure Duration in the SB direction.
- Segment 85-10 has overlapping needs in Pavement, Mobility, Safety, and Freight. Pavement needs are impacted by Failure Hot Spots located at NB Mileposts 143-146. Mobility Needs are impacted by elevated PTI in the NB direction. Safety needs are impacted by SB Safety Index. Freight needs are impacted by Freight Index, elevated PTI in the NB direction, and elevated Closure Duration in the NB direction.
- Segment 85-11 has overlapping needs in Mobility and Freight. Mobility needs are impacted by elevated PTI in the SB Direction. Freight needs are impacted by Freight Index and elevated PTI in the SB direction.
- Segment 85-12 has overlapping needs in Bridge and Mobility. Bridge needs are impacted by the structural evaluation of Gillespie Canal Bridge at MP 120.25. Mobility needs are impacted by Mobility Index due to Current and Future V/C, and high level of need in Bicycle Accommodation due to shoulder widths.
- Segment 85-13 has overlapping needs in Mobility and Freight. Mobility needs are impacted by elevated scores due to Current and Future V/C, elevated TTI and PTI scores, and Bicycle Accommodation showing a higher level of need due to shoulder widths.

Table ES-3: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)													
	10W-1	10W-2	10W-3	10W-4	10W-5	10W-6	10W-7	10W-8	85-9	85-10	85-11	85-12	85-13	85-14
	MP 0-16	MP 16-22	MP 22-32	MP 32-54	MP 54-71	MP 71-82	MP 82-98	MP 98-113	MP 155-149	MP 149-139	MP 138-123	MP 123-120	MP 120-118	MP 120-123
Pavement	Low	None*	None*	Low	None*	Low	None*	None*	None*	Low	None*	None*	None*	None*
Bridge	Medium	Low	Low	Low	None*	None*	None*	Low	None*	None*	None*	Medium	Medium	None*
Mobility+	Low	None*	None*	None*	None*	Low	Low	Low	Low	Low	Low	High	Low	High
Safety+	Low	Low	Medium	High	High	High	High	Low	High	Low	None*	N/A	N/A	N/A
Freight+	Medium	Low	Low	Low	Low	Low	Low	Low	High	Low	Medium	None*	High	High
Average Need (0-3)	1.38	0.62	0.85	1.23	0.92	1.31	1.15	0.85	1.62	0.85	0.69	1.30	1.60	1.80

\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.

+ Identified as an emphasis area for the I-10/SR 85 Corridor.



# STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State’s key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need as addressing these needs will have the greatest effect on corridor performance. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes.

The I-10/SR 85 strategic investment areas (resulting from the elevated needs) are shown in **Figure ES-6**.

## Screening Process

In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need.
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment issues. These hot spots will likely be addressed through other ADOT programming means.
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need. This bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes.
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project).
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need.

## Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT’s traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the I-10/SR 85 Corridor will be considered along with other candidate projects in the ADOT statewide programming process.

Candidate solutions include some or all of the following characteristics:

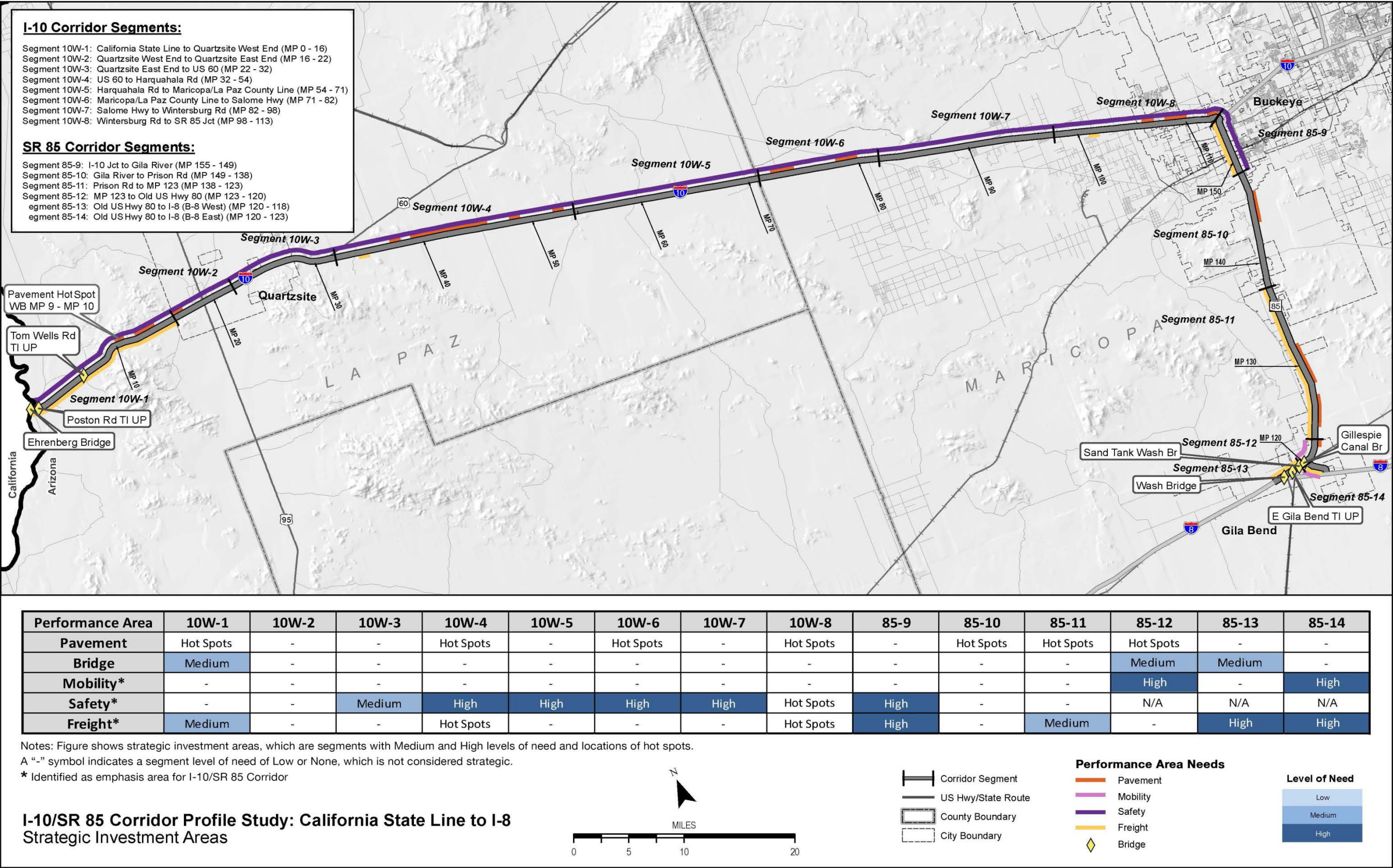
- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance areas include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.



Figure ES-6: Strategic Investment Areas





# SOLUTION EVALUATION AND PRIORITIZATION

Candidate Solutions were evaluated in multiple steps including a LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation is shown in **Figure ES-7** and described more fully below.

## Life-Cycle Cost Analysis

All pavement and bridge candidate solutions have multiple options, rehabilitate the area of need, or fully reconstruct the issue area or structure. These options are evaluated through a LCCA to determine the best approach for each location where a pavement or bridge solution is recommended. The LCCA could eliminate options from further consideration and will identify which options should be carried forward for further evaluation.

All Mobility, Safety, and Freight strategic investment areas that result in multiple independent candidate solutions are advanced directly to the Performance Effectiveness Evaluation.

## Performance Effectiveness Evaluation

After the LCCA process are complete, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a performance effectiveness score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Evaluation to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

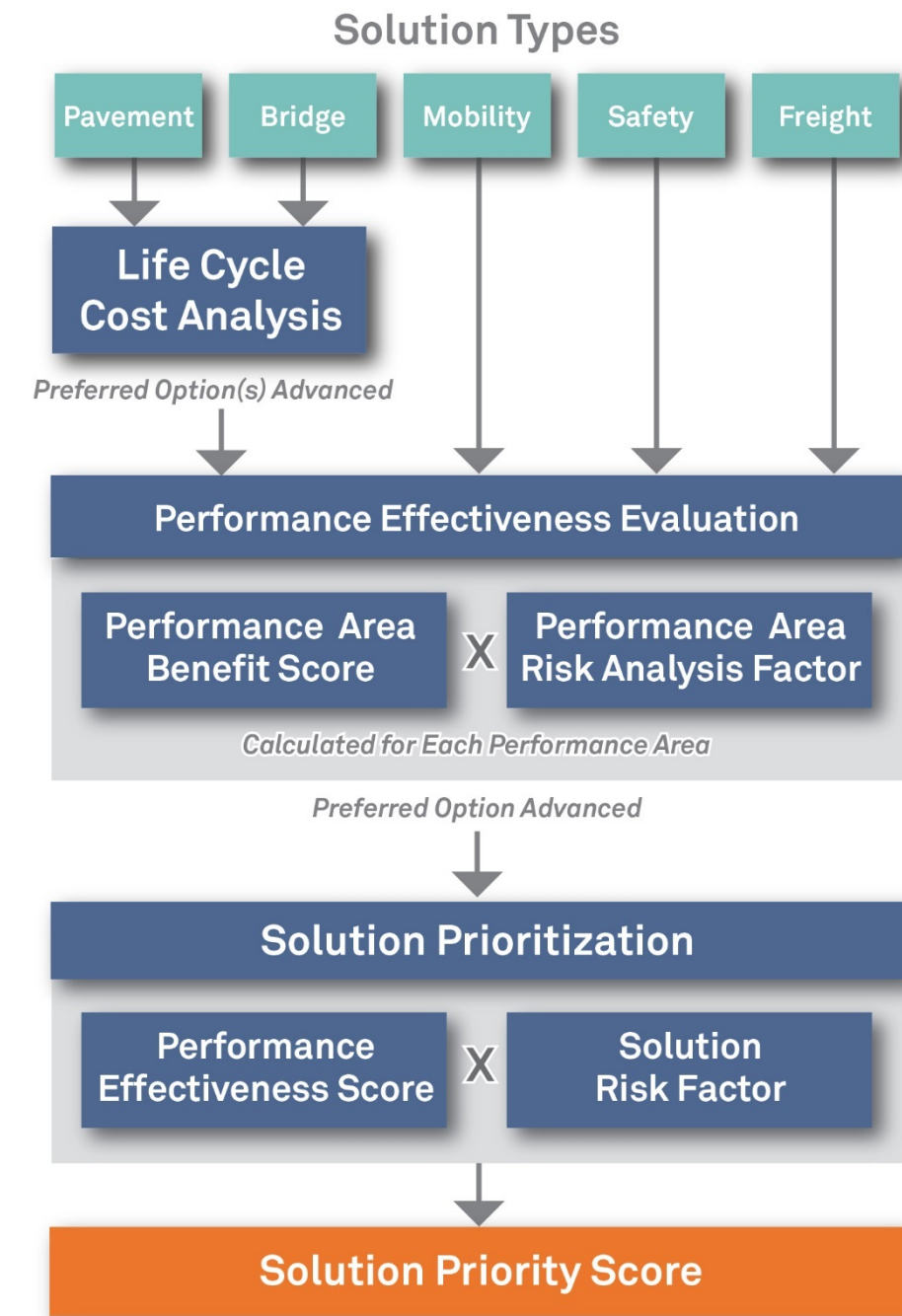
## Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Risk Analysis process. The risk analysis is conducted to develop a risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

## Candidate Solution Prioritization

The PES and risk factor are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure ES-7: Candidate Solution Evaluation Process



# SUMMARY OF CORRIDOR RECOMMENDATIONS

## Prioritized Candidate Solution Recommendations

**Table ES-4** and **Figure ES-8** show the prioritized candidate solutions recommended for the I-10/SR 85 Corridor. Implementation of these solutions is anticipated to improve performance of the I-10/SR 85 Corridor, primarily in the Mobility, Safety, and Freight performance areas. The highest priority solutions address needs in the Gila Bend and Buckeye areas.

## Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the I-10/SR 85 Corridor:

- When recommending future projects along the I-10/SR 85 Corridor, review historical ratings and levels of investment. According to data used for this study, the following pavement and bridge locations have exhibited high historical investment (pavement) or rating fluctuation (bridge) issues:
  - Pavement: MP 0-16
  - Pavement: MP 54-71
  - Bridge: Tom Wells Rd TI (MP 5.84)

## Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through the CPS process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on I-10/SR 85, but across the entire state highway system where conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects

- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

## Next Steps

Candidate solutions developed for the I-10/SR 85 Corridor will be considered along with other candidate projects in the ADOT statewide programming process. It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.



**Table ES-4: Prioritized Recommended Solution List**

Rank	Candidate Solution	Candidate Solution Name	Description/Scope	Estimated Cost (in millions)	Investment Category Preservation [P] Modernization [M] Expansion [E]	Prioritization Score
1	85.12A	Buckeye Safety (MP 155-149)	Install chevrons on the I-10/SR 85 interchange ramps. Install intersection warning beacons on SR 85 at the intersection approaches for Broadway, Southern, and Baseline Roads. Install larger stop signs with flashing beacons along Broadway, Southern, and Baseline Roads (both directions) at approaches to SR 85 intersection. Project will include the construction of acceleration and decelerations lanes for cross traffic merging at Broadway and Southern Roads.	\$2.13	M	164
2	85.14A	Butterfield Trail Widening (MP120-123)	Construct new general purpose lanes and a center left turn lane along Butterfield Trail between MP 120 (Jct. I-8) and MP 123 (Jct. SR 85). Project will convert existing 2 lane undivided facility to a 5 lane undivided facility including shoulder rehabilitation.	\$11.75	E	158
3	85.13	N. Gila Bend GP Lanes (MP 120-123)	Construct 2 Southbound general purpose lanes west of the existing alignment to create a 4-lane divided highway between MP 123 and Maricopa Road. The existing alignment will become 2 Northbound general purpose lanes. As part of this project, access to the airport on the east side of SR 85 will need to be reconfigured.	\$30.07	E	65
4	10W.5	Vicksburg Safety(MP 32-50)	Rehabilitate the outside shoulder including mill and replace pavement, rumble strips, raised pavement markers, and necessary striping from MP 32 to 50 in both EB and WB directions. Project will also include the installation of CCTV cameras at the existing EB and WB DMS at MP 49.4.	\$10.25	M	49
5	10W.8	Vicksburg to Palo Verde Lighting (MP 54-103)	Install lighting at EB and WB interchange merge points at MP 54, 69, 81, 98, 103 to improve visibility.	\$2.49	M	34
6	10W.9	Tonopah to Palo Verde Safety (MP 82-112)	Widen the outside shoulder including mill and replace pavement, rumble strips, raised pavement markers, and necessary striping from MP 82 to 112 in both EB and WB directions. Project will include the installation of dynamic speed feedback signs at EB MP 85 and WB MP 110. In addition a CCTV camera will be installed at the existing DMS at MP 110.	\$38.36	M	26
7	10W.7	Centennial Safety (MP 54-71)	Widen the outside shoulder including mill and replace, rumble strips, raised pavement markers, and necessary striping from MP 54 to 71 in both EB and WB directions. Project will include the installation of dynamic weather warning beacons at MP 66, 68, 70, 76, 78, and 80 as well as RWIS at MP 70 and 77.	\$23.42	M	19
8	10W.10	355 <sup>th</sup> Ave Vertical Clearance (MP 101.4)	Re-profile mainline I-10 to increase vertical clearance under the 355 <sup>th</sup> Avenue overpass.	\$0.48	M	14
9	10W.11	I-10/SR 85 Jct. Ramps (MP 112-113)	Modify existing EB/WB entry and exit ramps to a parallel configuration.	\$4.43	M	7
10	10W.3	US 60 Interchange Safety (MP 27-31)	Improve skid resistance of pavement between MP 27 and 31 in both EB and WB directions. Project will include the installation of chevrons throughout the curve between MP 28 and 29.5 in both directions as well as dynamic speed feedback signs at the approaches to the curve (EB MP 27 and WB MP 31).	\$13.73	M	7
11	10W.4	US 60 TI Ramp (MP 31)	Modify existing EB/WB entry and exit ramps to a parallel configuration.	\$4.43	M	4
12	10W.1	Ehrenberg Pavement WB (MP 9-16)	Replace pavement between MP 9 and 16 in the WB direction. Project to include pavement, over excavation, striping, delineators, raised pavement markers, and rumble strips.	\$25.15	P	4
13	10W.6	Bouse Wash Rest Area Ramps (MP 52.5)	Modify existing EB/WB entry and exit ramps to a parallel configuration	\$4.43	M	2

Figure ES-8: Prioritized Recommended Solutions

